LIFE OR DEATH IN INDIA

BY

FLORENCE NIGHTINGALE

A Paper read at the Meeting of the National Association for the Promotion of Social Science, Norwich, 1873

WITH AN APPENDIX

ON

LIFE OR DEATH BY IRRIGATION

1874

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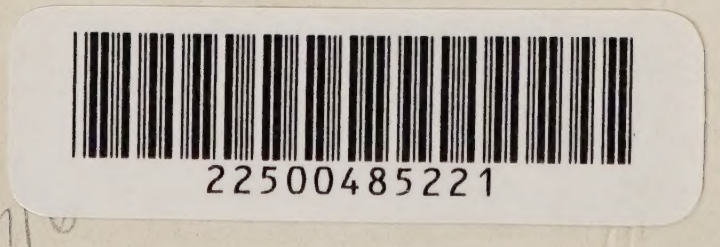

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HOW SOME PEOPLE HAVE LIVED, AND NOT DIED, IN INDIA.

By Florence Nightingale.

On a former occasion I ventured imperfectly—for India is immense, while a paper is small—to bring before the Association how people have died, and not lived, in India; how people may live, and not die, in India.

I used some of that great body of information brought together by the 'Royal Commission on the Sanitary State of the Indian Army,' which was at work during four years, 1859–1863, and was presided over, first by Sidney Herbert—whose statue still stands before the War Office as a witness in favour of progress—then by Lord Stanley, now Lord Derby.

Ten years have elapsed, during which most of the sanitary proceedings which have been initiated, and their results, have passed (on paper) through our hands. And we may now reckon up our gains.

2. I must begin by guarding myself and others. A caution.
We *have* made an impression on the sanitary state of

that vast country; but 'impression,' so far as this: only to show us the immense work that remains to be done; the immense success that *can* attend it—we cannot yet say the immense work that has been done.

But how much this is; what progress since the time we were taught to lament the 'hopeless Indian climate'!

What is the epidemic state.

The caution is this: as in all epidemic countries, more than in most—the death-rates of the Indian Army had shown two characteristics: they fell and they varied according to the nature of the season and the prevailing 'epidemic state.'

(1) E.g., in past, and, alas! in present years, we can say approximately what districts will be visited by fever or by cholera in 'epidemic' times: 'if the drainage and water supply, and neighbouring ground are left in *that* bad state'—when comes the 'epidemic,' those dwellings may expect it. If air, earth, and water continue to be fouled, if foul damp ground be not drained, if the public ways be not better kept, when comes the 'fever,' when comes the 'cholera,' those districts will have it.

But why does not cholera come every year to those dwellings? Their state is the same. And why is fever not always in those districts?

We do not know.

All we can say is, we know into what dwellings cholera and fever will *not* come, however 'epidemic' the year; we can put towns and districts into such a state that the *epidemic*, like the mediæval witch, is exorcised, so that it cannot come near them.

More than this we do not know.

(2) In past years—not so long past—in a great town of England, 47 children out of every 100 used to die before they were five years old. But why those 47?

We do know how this infant mortality, or rather massacre of the innocents, can be mitigated or prevented; namely, by cleanliness of house and child, by fresh air, care as to food and clothes, whitewashing, by 'minding baby' in short, and by avoiding all 'soothing syrups' whatever.

But we do not know which babies will be taken and which not.

All this is pre-eminently true of India. From the great Sunderbunds, where cholera seems to have had its birth-place, and had not been born some centuries ago [great towns, shown in old Portuguese maps, now no longer to be found, seem to attest that the Sunderbunds were not then the home and hearth of epidemics], cholera sets forth on its terrible march over Asia, so reaching Europe; but why in one year and not in another we know not.

If the Sunderbunds were drained, cultivated, and again rendered fit for human habitation, would cholera disappear?

Satisfactory Sanitary results in 1871.

3. Now, after this caution, to proceed: The results we find, in the last Report* of the 'Sanitary Commissioner with the Government of India,' and in other District Reports, have been so striking, that they

* Dr. Cuningham's Report, No. 8.

may be fairly accepted as showing, not that India has become 'healthy for ever' (the year 1871 was a non-epidemic year), but that we can grapple with—that we may one day finally subdue, if we will—spite of the bugbear 'climate'—those local conditions which in former days decimated the strength of the Army, and which, unless preventable and prevented, make up a terrible prospect—that only at such a price could India be held by a British force. And this when man's life was becoming every year more valuable.

In the first part of this century the Death-rate among British troops serving in India had revolved round 69 per 1,000 per annum ; that is, 69 men out of every 1,000 died on an average every year.

The 'constantly sick'* in hospital amounted in old times to ten per cent. of the strength ; that is, out of every 1,000 men 100 were always ill in bed.

Or, in round numbers, the whole British Army went three times into hospital every year. The Royal Commission of 1863 gave a Table showing, as they state, 'that on an average in the stations of Bengal 84 men in a battalion of 1,000 were constantly in hospital, where 69 die annually.'

But men invalided 'are a total loss to the service as much as the men who die; '—indeed more so, as far as the country is concerned, for they have to be supported.

And the loss by invaliding was, as may be supposed, high in proportion :—in Bengal, as high as between 80 and 90 per 1,000 per annum, including all such casualties.

* On the authority of Mr. Annesley.

Steps had been taken before,* steps were being taken during the inquiries in India of the Royal Commission, for removing some existing sanitary defects, with corresponding improvement of the health of troops.

The Report and evidence were printed, with an abstract of evidence from the Stations, by Parliament in August 1863.

In December, Sir John Lawrence was sent out as Governor-General (Lord Elgin's death impending), and almost immediately on beginning his vice-reign he formed an organisation for grappling with the evils, with this hundred-headed Hydra, in the localities themselves—in the home of the beast.

In this way of late years a vast amount of simple, inexpensive sanitary work has been done in respect of cleansing, draining, improving the water supply. In many of the cities and towns of the North-West Provinces this cleansing, the better making and keeping of public ways, the straightening and widening of streets, are now looked after.

In the North-West Provinces and in Oudh the civil stations have been improving their drainage, and the whole subject is marching on.

In the Central Provinces, we are told, improvements of various kinds are going on.

In Berar the people are thinking about it—thinking

* In Bombay, sanitary reform began with Sir Robert Grant forty years ago, according to *then* lights ; and subsequent Governors carried the work on, in advance of the *then* Indian ideas. The first scheme for an ample supply of good water to a city was matured in Bombay thirty years ago by Lord Elphinstone, and begun five years later—long before any such plans were believed to be possible in any other Indian city.

how bad is their water-supply. One trusts that they will go farther—though thinking is a good thing—and not only think but act.

In the Punjaub a good deal, we are told, is being quietly done in the towns.

In Bengal Proper, where most is wanted, least seems to be doing.

Many stations all over India—e.g., Barrackpoor, Umballa, Murree, Meean Meer—are supplying themselves with better water.

Many have had their barracks improved or reconstructed—not before it was wanted—and sometimes, it must be admitted, not in the most economical way.

Still the work has been done, and is being done, very zealously, as is shown by the Reports of Sanitary Commissioners, which give as striking instances of results to health from sanitary improvements as could well be imagined, were it even a Hercules who was working for us [these are real miracles of the present day] or as have been realised at home. And this has been done without burning down the city, which, it seems, was the only way of saving London from another great plague.

Army: Death-rate and Sick-rate in 1871.

4. And first, as regards the Death-rate of the Army: For on this subject Dr. Cuningham gives some most important facts, especially as regards Bengal, formerly, as we know, the most unhealthy province—if province it can be called—a country of nearly 69,000,000—the most densely populated in the world.

Formerly the Death-rate for all India revolved

round 69 per 1,000. In 1871 the Death-rate, including deaths among invalids *after* their arrival in England, was 18·69 per 1000. [The strength was 56,806 non-commissioned officers and men]; that is, 18 men died where 69 died before. Of the invalids sent home to England, 16·02 per 1,000 on a similar strength were discharged the service.

From these facts we arrive at this result: namely, leaving out the loss from invaliding in the old Indian Army altogether, the total loss to the present Indian Army in 1871 by deaths *and discharges* was 34·7 per 1,000, or just one-half of the loss occasioned by the old death-rate alone. In other words, we lost, in 1871, 18 men only by death—in India and England both—out of every 1,000 of the British Indian army; and 16 more were discharged as unfit for further service; that is, there was a saving of 51 men in every 1,000 in 1871 (a healthy year), or 2,858 men in an army of 56,806 were the savings of that year: one year's results: as compared with the average losses of old.

Let us remember, with the mercantile Briton's spirit, that every man costs with his arms 100*l.* set down in India: hence £285,800 was the money saving on recruits in that year.

But what is the value of a man otherwise?

To *us* these are not figures, but men.

Returning to the Bengal Presidency, we find in 1871 the deaths 17·83 per 1,000, where formerly the Bengal death-rate lay between 70 and 80 per 1,000, and annual losses from other casualties actually rose

to between 80 and 90 per 1,000. In other words, 17 men only die instead of 70.

A few results for 1871, from different groups of formerly most unhealthy Bengal stations, tend to show that the improvement in health is going on ; thus :

In Bengal Proper the death-rate for the ten years preceding 1870, including a time of sanitary improvement, was 29½ per 1,000 ; and the daily sick nearly 7 per cent., or 70 per 1,000. In 1871 the death-rate was 18·72 per 1,000, and the daily sick-rate 5 per cent., or 50 per 1,000.

General Sick Rate. Let us here add, that in round numbers the whole Indian Army went once-and-a-half times into hospital, and about 5½ per cent. of the force was always in hospital, during the year 1871, instead of nearly double the number.

Fort William. We all remember the frightful sickness and mortality of Fort William. Its sick-rate continues rather high, but its death-rate in 1871 was only 10 per 1,000, less than a tenth part of its former death-rate : and 2½ per 1,000 less than the death-rate of 1870.

Oudh. In Oudh the death-rate from 1860 to 1869 was 28½ per 1,000. In 1871 it was under 23. The constantly sick had also fallen from 69 to 61 per 1,000.

At Cawnpore much has been done to improve the site, and the station shows a death-rate of only 13 ; while Benares and Allahabad, in which less has been done, and Dinapore, in which we do not hear of much done, show quite double this rate of death.

Meerut. Meerut and Rohilcund, in the ten years before 1870, were sick at the rate of 72 per 1,000, and sick

unto death at the rate of 26½ per 1,000. In 1870 these fell to 69 and 18½ respectively; and in 1871 to 65 and 16½. But in this group Roorkee, which has always distinguished itself, and Moradabad died at the rate of only 8 and 5½.

Agra. In Agra and Central India, for the ten years before 1870, the sick-rate was 74, and the death-rate 38½ per 1,000. In 1870, though the sick-rate was 77, of these there died only 22 per 1,000; and in 1871 there were sick only 64, and there died under 18½ per 1,000.

Punjaub. In the Punjaub, there has been apparently some progress in improving the heavy sick-list. The ten-year period shows sick at the rate of 56, and dead at 25; but 1870 gives daily sick at 69, and deaths at under 24½ per 1,000; and 1871, sick at 54, and dead at little more than 18 per 1,000.

Hill Stations. Now the Hill stations come in. During the ten years before 1870 the daily sick were 49, and the dead nearly 15 per 1,000. In 1870 the sick were 40, and the dead 11. In 1871, 48 and 9. But at one Hill station, Raneekhet, the death-rate was as high as 24 ; while at another, Chukrata, it was under 6½; and at Dugshai 5½.

Convalescent Depôts. Now for the convalescent depôts: These gave a death-rate of nearly 31 per 1,000, during the ten-year period ; for the men seem to have died rather than convalesced—whereas in 1870 it was little over 22½, and in 1871 under 13 per 1,000.

The Army Sanitary Commission concludes its notice of this part of Dr. Cuningham's statistics by ' congratulation at the improvements already effected

in the sanitary condition of stations and troops serving in the Bengal Presidency;' especially, it says, when the former history of the old Bengal European Army is considered, with its annual death-rate 'of from 70 to 80 per 1,000;' and 'its annual losses from other casualties of between 80 and 90 per 1,000.' But it warns us not to delay measures for making the statistics of 1871—'an avowedly healthy year'—the real representative statistics of every year in India.

For it must not be assumed that the work of improvement is done.

Far from it.

The general result only indicates progress towards realization : not realization.

As yet *what is* BEING *done* is all we have to show.

The Royal Commission pointed out that the death-rate, when we have *prevented preventable* diseases, ought not to be more than ten in the thousand.

The importance of the present results consists in showing that India is not necessarily fatal to European lives, and that the Government of India, the India Office at home, and the British public, have not only a common interest in the results already attained, but that they have a right to expect, and do expect, that their officers' hands shall not be stayed in this good work; that they shall be assisted in every possible way. Expense has been incurred—somewhat more perhaps in certain directions than was necessary. But has there been no gain?

It has been shown that we are in the way of regaining every year a large part of the outlay.

5. Had time permitted, some account should have been given of the success of sanitary work in India in cities, and even in country districts.

But we must be content with a few illustrations.

Ten years ago I reported to the Royal Commission that no one of those three large and populous cities —seats of Presidencies—Calcutta, Bombay, Madras— had as yet arrived at the degree of civilisation in their sanitary arrangements at which the worst parts of our worst towns had arrived before sanitary reform sprang up in England at all. Calcutta, Bombay, Madras.

Yet all the fault of the inevitable results was laid to the 'climate.'

Bombay, the second city of our Empire, had, it is true, a better water-supply, but no drainage.

Calcutta was being drained, but had no water supply.

Two of the seats of Government had thus each one-half of a sanitary improvement, which halves ought never to be separated.

Madras had neither.

This was ten years ago.

Now (and I cannot but name the name of the Calcutta municipality engineer, Mr. Clark, with this great improvement—let us give him a cheer), Calcutta has its water-supply complete: all classes, all castes, use it; and find, indeed, the fabled virtues of the Ganges in the pure water-tap. Calcutta.

Draining has been going on, subsoil and surface: the subsoil water-level effectually lowered; and not only this, but a fine current of water runs through the subsoil from the river on one side to drainage out-

lets on the other, carrying with it old sewage out of the subsoil. The main drainage of most of the town is complete, and native owners of houses are already applying for private drainage—a fact of great importance.

Still there remain to be provided for—to make the Sewerage perfect—connections between the main sewers and the houses (and especially in large districts of the poorer population, and in the Bustees—'temporary' villages, of mat and thatch and mud).

Many miles of ditches have been filled up, to the great detriment of mosquitoes and great comfort of the inhabitants.

Then, also, the sewage is being applied to agriculture.

And what has been the result of all this sanitary engineering?

From 1866, when the deaths from cholera in Calcutta were little short of 7,000, they have decreased to 800 in 1871, the lowest number of deaths on record. Calcutta in 1871 was more salubrious than Manchester or Liverpool, and may be considered soon a sanitarium compared with Vienna, or even with Berlin, where the city canals are still fouled with sewage.

Still we must not 'sing before we are out of the wood.' Much, as Mr. Clark and Sir George Campbell would tell us, remains to be done.

And before the inhabitants of Calcutta can hope to be free from finding themselves any morning in the claws of some epidemic disease, they must have done

a great deal more to the *houses* of the *people*, crowded as they are on small unhealthy space, and to the undrained districts surrounding, and especially below Calcutta.

Caste prejudices have been alleged as insuperable stumbling-blocks in the way to sanitary improvement, but a curious and cheerful instance of caste prejudice being overcome is this : when the water-supply was first introduced into Calcutta, the high-caste Hindoos still desired their water-carriers to bring them the *sacred* water from the *river* ; but these functionaries, finding it much easier to take the water from the new taps, just rubbed in a little (vulgar, not sacred) mud, and presented it as Ganges water.

When at last the healthy fraud was discovered, public opinion, founded on experience, had already gone too far to return to dirty water. And the new water-supply was, at public meetings, adjudged to be theologically as well as physically safe.

Besides its water-supply, then, the drainage of Calcutta bids fair to be a wonder of the world, when we remember what has been loudly said, even in this our day, that Calcutta at least was hopeless, because it lies close to the level of the river; and its public health has equally defied the prophets of irremediable evil, and will yet improve still further its powers of defiance, while the active—not prophets of evil, but performers of good—Mr. Clark,* and the energetic Lieut.-Governor of Bengal, and other such authorities live.

* Unhappily, since this was written, Mr. Clark has been obliged to come home invalided.

Bombay. Now for Bombay—Bombay, hitherto the pioneer : Bombay the active, not to say restless, the energetic Bombay. Bombay has for years done everything to drain itself, except doing it : it has had the best engineer, Major H. Tulloch, to look at it, to plan for it ; it has had surveys, plans, reports, paper, and print enough to drain all India—writing and talking enough for a thousand years. The only thing it has *not* done is *to do it.*

In the meantime it has had to thank its able Dr. Hewlett, the most vigorous of health officers—now alas ! no longer at that post—for having, at a quite incredible cost of time and energy, in organising, personally superintending, and being as it were the constantly present head of an immense and most expensive system of hand-labour, saved them from cholera epidemics, and done that for them, single-handed, or rather single-headed, which should have been better and more cheaply done by the civilised hand of engineering and machinery. He has been a sanitarily engineered city in himself—his own Reports are his best witnesses.

As for the water-supply, much the same may be said. The increased water-supply needed by the city is still on paper, some small portion only having been obtained.

And what has Madras done—Madras which had neither—neither water-supply nor drainage ?

Madras. Madras has obtained a water-supply, and has just improved it, and is applying part of her sewage to agriculture with success. In other respects she

appears to be pretty much as she was, with her filthy Cooum estuary, and her foul, undrained area.

She has recently had the census taken, with the advantage of discovering that Madras is a very unhealthy city.

Madras Presidency.

6. These illustrations would be incomplete if taken only from the large cities. Here, however, are a few experimental results described by the Sanitary Commissioner for Madras in his report on cholera of 1870. Cuddalore town had forty-two deaths from cholera out of a population of 28,421. Cuddalore jail with 301 prisoners escaped. The jail had those two indispensable requisites—good water and perfect cleanliness—which were absent in the town. Madura town contains 39,872 people, of whom 376 died of cholera, which, on arriving there, found bad conservancy, foul privy arrangements, foul subsoil, contaminated water. There are two jails at Madura, one old, the other new. The old jail had bad water and other insanitary conditions, and lost four out of fifty prisoners by cholera. The new jail contained 180 prisoners ; these were the only persons not exposed to sanitary defects, and they all escaped cholera.

Rajahmundry town, where the population live under the usual Indian insanitary conditions, lost 147 people from cholera out of a population of 17,498. The district jail, situated within the town, and under similar conditions, lost 16 prisoners out of 89 by cholera. The new central jail, where the sanitary conditions were good, had not a single case of cholera among

845 prisoners, although the disease prevailed 'violently in all the country round.'

Vellore town lost 67 people out of 30,529 from cholera. It has two jails, one old, the other new. The sanitary condition of the old jail was rigidly attended to, and there was no cholera among its 152 prisoners. The new jail had 576 prisoners, but no cholera. It occupies a healthy site, and its sanitary arrangements were good.

More sanitary experiments of this kind could be cited, but here is one of special interest regarding villages :—

Mr. Kearns, a Church Missionary in Southern India, states that on his arrival at Puthian Puttur, in 1856, few villages had suffered more from cholera and fever. The place was wretched and foul, and had bad water. To remedy this state of things, wells were dug and properly protected ; surface drainage was improved, rigid cleanliness enforced, trees planted, and other improvements introduced. Similar improvements were carried out in other villages.

And they escaped cholera.

It is worthy of remark that the facts were brought out, in reply to a statement made by the Madras Government, that this village was exempt from cholera, 'cause unknown.' Mr. Kearns replied to this by showing that he was perfectly well aware of the 'cause.' Quite recently, improvements of a similar kind, including reconstruction of houses, in the foulest and most unwholesome parts of the city of Madras, have been

attended not only by an enormous diminution in the district death-rate, but the people have improved in civilisation as well as in health.

Bengal. Country Districts and Villages.

7. But one more word about country districts.

And let us remember that Bengal is the most thickly populated country in the world—a country of villages.

Till country drainage is introduced, till agriculture is improved, till irrigation and drainage are combined —both better when together, the first dangerous when apart—no great improvement in health, civilisation, or vigour of the people can be expected.

The 'drain' in another sense, the drain upon human life and happiness, of *fever* in India is literally untold. But as far as *can* be told—in 1871, a peculiarly healthy year, about one-and-a-half millions of people died in India from fever, or nearly 12 in every 1,000, or 23 times as many as cholera destroyed.

But this is a mere trifle compared with the ravage fever commits in sapping the strength and vigour of the country, in making the young old, the healthy infirm for life, the industrious helpless invalids, the rich poor, the thriving country a waste.

The deaths must first be multiplied by 50 or 60 to give us the attacks.

Then, a man who has once had a bad attack of malaria has it for life.

And almost all this fever is malarial.

Cholera destroys life, but does no more.

Fever destroys the life of the country; saps the world in which it is.

Look at the Burdwan fever; look at the Dengue fever.

'Dengue' is rarely fatal, but in its districts 'Dengue' is master, and 60 or 70 out of every 100 are 'down' with it!

Irrigation. Irrigation is essential in many parts of India, but irrigation with stagnant water is almost as injurious to crops as to health. Irrigation should be accompanied by improving the natural drainages of the country, so as to keep the water moving, however slowly.*

Let me tell a curious history told me by one of the members of the first Bengal Sanitary Commission. In 1857 nine miles of country, with twenty-five villages, were laid waste by fever; death came sometimes in three hours; of 600 in a village only a few in the centre houses lived. All the others died or fled. All the other houses were unroofed and tenantless. In the other villages nothing was left but pariah dogs. The crops were uncut. The dead lay about in the hollows, unburied and unburnt, for there was nobody left to bury them.

Where the people did live they degenerated mentally and physically.

The cause of all this was a screw turned by a coolie, which flooded the low lands from the Ganges canal

* As the meagrest discussion of the vital question of irrigation would occupy too much time here, it has been placed in an Appendix.

faster than the water could be carried off. The man at the screw (at four rupees a month) ruled the destinies of a large population, not only as to health and life, but as to soul and mind, according as the screw turned to the right or to the left.

This, the cause, was found out—only a few months before my informant gave me the account, through an inquiry made by Sir John Lawrence.

And all the time the people were going on degenerating, except those who were dead.

This melancholy history is given here (merely as an illustration; did time permit, hundreds such might be told), not for our discouragement, but for our encouragement; not because it is so hopeless, but because it is so hopeful. If the screw turned too much brings fever, the screw turned just right brings plenty and health.

Let the people only see how much they can do for themselves in improving their surface drainage, in keeping their water supply free from pollution, in cleansing inside and out.

Let the Government see how much they can do for the people in introducing and stimulating better agriculture; irrigation, combined with drainage works in water-logged districts; for the two must never be separated there.

There is not a country in the world for which so much might be done as for India.

There is not a country in the world for which there is so much hope.

Only let us do it.

Drink.

8. Unfortunately there is one disease-cause in the British Army quite beyond the influence of engineering works, for every man is his own disease-cause, and must be his own remedy.

And this is: drink.

The quart of porter and quarter of a pint of spirit per day are still procurable at the canteen, and as much more as the men like (and as will destroy them) at the bazaar—and will always send to the graveyard and invaliding depôt a large number of men every year, until they are made to understand their own interest, and are furnished with employment.*

Caution again.

9. I might have ended here by repeating the caution with which I began: not to stay our hand, because the year 1871 gave a death-rate of only 18 per 1,000 ; but the experience of 1872, just coming in, justifies, unhappily, but too well, all the caution that can be used.

The disease death-rate of 1872, minus the super-added epidemic death-rate, was as low as that of 1871. But cholera intervened, and raised the death-rate materially in Bengal, though very little in Bombay and Madras.

* Is there no possibility of checking drunkenness by a system like that of 'equivalents' in the Navy? so that a man might drink his ration of spirits, or have its equivalent in coffee, beer, meat, &c., or in money.

Would it not pay Government to give men 5 per cent. compound interest on the price of drams so foregone, either paying in a lump on discharge, or, better still, giving an additional pension?

This is no reason for discouragement, but the reverse.

It is not a defeat, but an attempt of the enemy to turn our flank.

We know enough of his strength and his arms to turn the check into a victory, if we are only wise.

But is not the following an example of action quite other than wise ?

Quarantine.

The report by the 'Sanitary Commissioner with the Government of India' on this same cholera of 1872 tells that people have been trusting much to quarantine for safety, and that quarantine has been fully tried, with results such as the following: 'In a question so intimately connected with the happiness of the human race, it cannot be too widely known that quarantine was tried in the hope of protecting a number of the cantonments of Upper India; that in many of them it signally failed, and that in no single instance is there the smallest reason to believe that it was productive of any good. The direct evils of quarantine are great enough, but . . . by no means the least indirect evil is this, that so long as men believe that they can escape from cholera by such means, they will never be fully alive to the importance of the greatest safeguard, sanitary improvements.'

Forced removals of sick, especially of women, for quarantine purposes, and other restrictions 'set the people against everything that is done under the plea of the public health,' and the sanitary reformer is regarded 'as the greatest destroyer of their domestic comfort and happiness.'

As a consequence, cholera cases were concealed.

The troops also had to bear their share of this mediæval infliction. The evils are described as 'very great.' 'The troops are exposed to form cordons at the very time that exposure, and especially exposure to the night-air, is calculated to prove most mischievous.' Two stations, Meean Meer and Umballa, appear to have suffered from this. Both supplied complete cordons, and both suffered severely from cholera. No better *reductio ad absurdum* of the whole practice could be given than the fact that the fear of spreading cholera interfered with the more decisive moves of troops which were their best chance of safety from cholera.

And then, to crown the whole, there does not appear to have been a single instance in which quarantine could be rigidly enforced.

The Government of the Punjaub has taken the common-sense course of prohibiting quarantine except by special orders; and in the case of organised bands of pilgrims.

Sanitary reformers, like other reformers, have more to fear from their friends than their enemies—

> Da chi non mi fido, mi guarderò io,
> Da chi mi fido, mi guardi Iddio.

Conclusion.

But we must stop; only, however, to bear emphatic witness how great are the sanitary deeds already achieved, or in the course of being achieved, by the gallant Anglo-Indian, as formerly we bore emphatic witness against the then existing neglects.

Let but the Government of India continue to sustain the energetic efforts of their officers, and at the same time insist on the municipalities and local authorities prosecuting the good work. This was of importance for the Central Government to do ten years ago, seeing that there was no local self-government at all; it is, if possible, of still more importance now, when there *is* some local self-government; but it wants guidance: which does not mean that the Governor is to *do* municipality himself, even though a very good municipality he would make.

The natives are always ready to be taxed, as far as obtaining, at least, a purer and more plentiful water-supply goes. There is never any 'discontent' about this. What they do not like is paying the tax and receiving no water; and in this they are not so far wrong.

The Lieut.-Governor of Bengal has invited, by proclamation, the payers of some of *his* rates [this as regards roads] to claim the benefits (or their share of them) of what they pay for.*

Thus it will be rendered not only an easy matter to hold the great Indian Empire by a British force, but benefits untold will be conferred on the vast populations of our fellow subjects of whom we have undertaken the charge.

* 'Every taxpayer is encouraged and invited to claim that the tax shall be fairly applied to the village roads or water channels in which he is interested. The Government will use every effort to see that such local claims are fairly met, and that every taxpayer derives a fair benefit from the tax which he pays.'—*Proclamation of Bengal Government*, August 1873.

APPENDIX.

HOW TO MAKE IRRIGATION HEALTHY.

The cause of irrigation has received a frightful significance from this Bengal famine, irrigation being literally a matter of life and death. Not whether we will have irrigation or not; but how to make it healthy, and how to pay for it, are our questions. Wherever water for irrigation and navigation exists, famine is effectually met.

The paramount necessity of combining drainage with irrigation was never forced upon the attention in Southern India, as it has of late years been in Bengal and the North-West Provinces.

In the great irrigated districts of the Godavery and Kistna in the northern part of Madras, and of the north-west provinces and Punjab, drainage is now being taken in hand on a great scale, as outbreaks of fever have shown the results of its neglect.

In Tanjore, south of Madras, where there are above 1,000,000 acres of irrigated rice, without a weed to be seen, the drainage is said to be of the rudest

description, yet the health of the people good. The population is more than 700 per square mile in the Delta. But the climate is a dry one; not moist like that of Bengal.

In this part of India the thermometer never falls so low in the cold months as it does farther north; and there appears to be some relation between the range of temperature at that time of the year and the prevalence of fever.

The Hooghly drainage investigation was taken up by the able Col. Haig, then chief engineer of the Irrigation Department, under the orders of the Lieut.-Governor, Sir G. Campbell, though there are no irrigation works there, in hopes of contributing towards the clearing up of the fever question, which has of late years assumed such enormous importance, or rather its enormous importance has only now come to be known. The fever seems partly owing to entire want of drainage, partly to foul drinking-water in the dry season.

Much more information than what Col. Haig managed, with all his super-eminent ability and energy, to collect in the course of a six months' enquiry, is said to be needed; and there is at least one point, the relative levels of sub-soil water, about which we as yet know far too little.

Col. Haig's 'Note' embodies certain facts in regard to the rainfall, surface levels, and drainage discharges of the district; but, as he states, he has no pretension to having exhausted the subject.

It is not, however, more enquiry that is most

needed. Enquiry and investigation are the curse of India, as of any country where we do not act up to the light we have: where evils are investigated and re-investigated fifty times over, simply as an excuse for *doing* nothing.

Everybody has known for half a century that, if the water of Bengal were regulated, the superabundance carried off during the monsoon, and plenty of water, fresh from the rivers, carried through every village in the dry season for irrigation, drinking, and carriage, the whole condition of the people would be immeasurably improved. All that is wanted is that the works should be executed; but this is the one thing that will *not* be done.

We shall have the country levelled and surveyed, the works planned and approved, report upon report called for, and commission upon commission appointed: anything that can be done as a reason for *doing nothing*.

Shallow water unhealthy.

1. One question is whether an area of ground, covered to such a depth with water as not to give off malaria from decomposition of dead organic matter, is necessarily unwholesome. This would be very much the condition of an ordinary tank, or of a lake in which the surface of the water is retained permanently at a fixed, or nearly fixed, level.

In the dry climate of Southern India such masses of water are said to be perfectly healthy; but in the warm, moist climate of Bengal the growth of aquatic plants is so prodigious that unless tanks are periodically cleared of the weeds and mosses, which form

in time a dense mat of vegetation on the surface, the water, it is said, becomes unfit to drink, and gives out deleterious gases.

But, in point of fact, such cases are extremely rare. As a rule the surface of every tank or collection of water falls several feet during the dry months, and exposes a margin of damp soil more or less saturated with organic matter, which is, of course, unhealthy.

Lower Bengal is one mass of tanks, mostly very small, in which every kind of pollution collects all through the dry season ; and from these in many places the people drink. All are natural hollows or formed by excavation—not, as in South and Central India, by damming up the outlets of valleys and hollows. But very few are dug out to such a depth as to leave, during the hot months, a sufficient depth of water to prevent decomposition, and fewer still are properly cleansed and protected from defilement by organic impurities.

Even in Bengal it is the poverty, not the will, of the people that consents to drink bad water. Whenever they have the means, they are glad to fence and line their tanks and wells with masonry. A sure sign of a thriving landowner is: masonry tanks and wells on his property. The rich often bring their water from immense distances, in sealed jars, on men's heads; and there is no such popular application of taxation as in improved water-supply.

Sub-soil water level.

2. Observations of the level of sub-soil water are doubtless most important.* It is stated, however,

* The precise relation between the level of the subsoil-water and

that in tracts in Lower Bengal where the fever has been most deadly the water-level in the dry months

the prevalence and intensity of fever has not yet been traced in Lower Bengal.

Both irrigation and drainage are there new things. The first irrigation work was not begun until 1862, and that by a private company: the Government expended nothing upon works of this class until 1868 or 1869.

The Dancienic Drainage Works, in the Hooghly district, carried out last year, are the first of their kind.

But in N.W. India—i.e. the N.W. Provinces and Punjab—some important facts have been established. In the districts on the upper part of the Ganges Canal, which were, of course, the first and the most copiously irrigated, there has been for many years a terrible increase of fever. By many it was asserted that the fever owed its origin to the canal; that the Mozuffernuggur District, e.g., which is now said to be so unhealthy that it is in general avoided by officials, was formerly one of the healthiest and most popular.

This, however, appears to have been clearly disproved. There is abundant proof of the existence of fever long before the canal was heard of. But this also seems to be certain that, wherever irrigation has been excessive, and stagnant pools and swamps have been formed, by carrying the minor distributary channels (as was formerly frequently done in the hurry of construction or from a faulty system) across the natural drainages, there has been a marked increase in the prevalence and virulence of fever.

Wherever the subsoil levels (which are usually termed the 'spring levels' in the N.W. Provinces and Punjab Reports) have been raised by supersaturation of soil from their original depth of twenty-five to forty feet to *twelve feet or less*, there there has been a terrible increase in the mortality from fever. Though still disputed, this fact is now pretty generally admitted by the best authorities, and in some official 'Resolution' of the N.-W. Provinces Government, it is distinctly laid down as the basis of remedial measures. Sir W. Muir is a hearty friend to irrigation.

How far this 'water-logged' state of the soil in the districts referred to is due to excessive irrigation, and how far to the faulty alignments of distributaries and neglect of drainage above alluded to is not decided.

But misuse of water is often made an excuse for not draining.

is at an unobjectionable depth below the surface, say sixteen feet. But it does not follow from this that, during and immediately after the rains, the sub-soil may not give out fatal malaria.

If the water rises too high during the rainy season, the difficulty in a rice-growing district is how to lower it.

The moment you cut a drain the ryots complain of it as injuring their crops by drawing off the water in which they always keep the rice standing to a depth of three to six inches, if they can get enough.

This is, of course, the consequence of partial work. What is wanted is a general *regulation* of the water, so that everywhere water shall be kept at the level required: some inches over the surface for rice: some feet under the surface, where irrigation is not needed.

Where the laws of drainage have palpably been violated, of course the remedy is plain and will be certain.

And much may be done by selecting new sites for villages on higher ground.

Rice cultivation, which consumes an enormous quantity of water, has greatly increased in the upper part of the Ganges Canal, and no doubt has been one cause of supersaturation. It is said that it has been determined to check this by raising the water rates! In the case of one large town where the fever had been severe, a committee recommended that the rice cultivation, which had crept right up to one town, should be prohibited within a certain distance of all dwellings.

Scientific sanitary irrigation is in its infancy. The danger is lest the abuse, or ignorant use, of irrigation should lead to its undue restriction, and cause the Government to hesitate in carrying out works on the scale required, at least, to secure the food supply of the country. Possibly, Sir G. Campbell, for one, was unduly influenced in this way; but his Government is so imperial that he never had *time* to think properly of the subject.

3. The ryots always, and justly, prefer *running* to stagnant water. Irrigation with stagnant water is injurious to health and also to vegetation. Irrigation should be accompanied by improving the natural drainages of the country, so as to keep the water moving, however slowly.

Moving water best for crops as for health.

But the difficulty is said to be, how to supply moving water, and make the works *pay* at the same time, for the whole surface of the country. Everywhere, however, water can be supplied for irrigation at a *cost* enormously below its *value*—the average *cost* of water in works on a large scale being about £2 per acre of rice.

Irrigation works are planned generally to supply one cubic foot per second to every 133 acres, which is the same as one cubic yard per acre per hour, or $\frac{1}{5}$ inch in depth on the surface per day. Two-thirds of a cubic yard per hour for 100 days are given for wheat or other 'dry grain,' and two cubic yards per hour for 120 days for rice, including rain—i.e. $\frac{1}{8}$ inch per day for dry grains and $\frac{3}{8}$ for rice.

To this extent, even if every cultivable acre in the country were irrigated, we can change the water; but, as only a certain proportion of the area commanded by the canals is irrigated, and of this all is not receiving water at the same time, we do, in fact, supply a greater depth, and in that degree renew the water lying on the surface.

In the rice districts in Madras the whole area is irrigated: in the wheat country out of the tropics in

the dry-season cultivation a portion only of the area is irrigated.

There is no doubt that the more water that is passed through the rice-fields in a running stream, the better the yield, both because stagnant water is more or less injurious, and because more water means more *silt*, which renews and fertilises the soil, and leaves, together with matter in chemical combination, behind it food for the plant.

It is certain that if the ground were thoroughly and sufficiently intersected by deep drains, and water enough supplied to meet the increased consumption which this would involve, rice cultivation might be a healthy employment. There is rarely fever in a village surrounded by rice swamp as long as the water is moving—'living,' as the natives say; the fever time begins when the water falls and stagnates.

Expense is the sole thing that stands in the way of all these improvements. As it is, our irrigation works in N. India are said barely to pay the interest on the outlay. Is this because we persist in debiting the works with the cost of all our blunders? Do we make a canal on a bad plan—twice as costly (say) as need be, and only half as useful—excluding navigation and cheap transit; and then, because it only pays 5 per cent., do we say, 'irrigation won't pay'? If we kept our turnpike road or bridge accounts in the same way, without reckoning consequences, should we not find that road-making and bridge-building was of all things the most fruitless application of

public money, and that it was better finance to build houses and let them as gin-shops?

The management of the works may be so wrong that, as in Orissa, the people refuse to use the water; and this is the case in only one out of the seven vast works which the Government have executed. The actual results are these; the cost of irrigation on these great works has been from £1 to £3. 10*s.* per acre, including the navigation; and the actual increased value of crop is from £1. 10*s.* to £2. 10*s.* in grain only, besides straw.

Is it not only because we are in such a hurry for results that the people seem slow to take water? Irrigation, unless it come from great rivers in flood season, when it renews the soil, requires manure; and manure costs money; and the people have to get a little money or credit before they can use their greatest boon.

Of the value of the canals for transit, the following may give some idea: Up the valley of the Ganges at least a million tons a year are carried at present prices, a small quantity by the rail at $1\frac{1}{2}d.$, besides half as much more paid out of taxes, and the main portion at about $\frac{1}{2}d.$ by the rivers; by the canals this would cost about $\frac{1}{20}d.$, or £200 a mile for a million tons, against £6,000 by rail, or £2,000 by river; a perfect steam-boat canal, 40 yards broad, on that line costing about £3,000 a mile.

The irrigation works in the north-west yield an enormous profit in all, about £1. 10*s.* in *grain* only, on an expenditure of £2. 5*s.* per acre, or 60 per cent.,

besides the straw and navigation (on the Ganges Canal).

And the area of irrigation is still extending. About 7 per cent. net of this now comes into the treasury. In the Jumna Canals, in the same part of the country, the returns into the treasury are 25 per cent., and in all the Madras districts double and treble that. The question of returns to Government,* though a point of importance, is of much smaller consequence than that of total benefits to the community. Besides its being a question of life or death, of health or disease, of civilisation, comfort, and cleanliness, or dirt and barbarism and misery, the average total benefits are at least 100 per cent. The Godavery district used to export £60,000 a year; it now exports, by sea only, £800,000 or £900,000 a year, besides the whole population being well fed and well clothed and housed; so that their home consumption is probably doubled. The 560,000 acres irrigated, then, now yield about £1,100,000 a year more in grain, besides straw and navigation, by an expenditure of about £600,000.

The results of the irrigation and navigation works in the Godavery Delta have been so conspicuous that I cannot but give the following short account: In 1843, when the first sketch of them was made by Sir Arthur Cotton, he and Lady Cotton took up their abode in tents and rough sheds on the bank of the

* Official papers are written as though the Government were simply a trading Company to whom the sole question was: What direct profit can be obtained?

river, or rather on the side of the river-bed; for only a narrow thread of water was flowing down the middle of that bed, and on each side of that thread was a mile and a half, at least, of hot, deep sand. The want and filth and need of every kind around were a continual, pressing sorrow. The weary faces of the women, toiling through the dry river-bed with their waterpots, creeping out of their huts after the exhausting heat of the day to bring the family supply of water between one and two miles, their naked feet sinking at every step in burning sand, were most distressing; and the thought how insufficient the supply after all the labour, painful to look back upon even now.

Sir Arthur and Lady Cotton remained in that district some years, till the works were fairly set on foot.

In 1861, they visited the Godavery Delta again, and describe the happiness of that visit. Instead of dry sand, the river-bed was covered full with abundant water; instead of parched, perishing attempts at cultivation, there were rich crops of many kinds, and trees which seemed to have sprung up as by magic; instead of filthy, *waterless* villages, there were channels, well filled, flowing everywhere; and instead of the weary, over-worked women, almost all looked well fed, well washed, and comfortable. One great obstacle to religious civilisation thus removed, the time and strength of mind and body need no longer be solely taken up with the daily drudgery which before absorbed every power. But, in this as in

other cases, the occurrence of Fever has warned us to look to our drainages.

rigation to e combined ith rainage.

4. No one, now-a-days, would think of proposing irrigation without drainage.

There is no danger in the one provided the other goes with it.

The engineer's problem is to apportion the one to the other, so as to increase production without injuring health.

egeneration ue to alaria and ck-renting.

5. Whether the physical degeneration of the people in and over Bengal is due solely or chiefly to malaria, or to malaria and rack-renting combined, is just the point which a commission might be appointed to investigate. But the drainage and irrigation works should be executed first. About these there is no doubt. This is as well known as St. Paul's. And the investigation may be carried on afterwards.

Under the permanent settlement the share of the produce of the soil left to the cultivator is often too little for health. A process of slow starvation may thus go on, which so enfeebles the great mass of the people, that when any epidemic sets in they are swept off wholesale. Land is let and sublet to a degree unknown anywhere else. The Zemindar will let his land to a Patnidar, the Patnidar to a Durpatnidar, the Durpatnidar again to a Seypatnidar, and he again may farm it out to an Izaridar.

Under such a system what portion of the produce do we suppose falls to the share of the ryot who tills the soil?

Then, population has increased to a degree that has raised the fear lest it may have outstripped the productive powers of the soil.

After at least half a million souls had (in the estimate of the present collector) been swept off by the fever in the Hooghly district, the population was still at the rate of 1,000 to the square mile.

But the productive powers of the soil under irrigation are enormous. *One* crop of rice without any manure at all will produce sufficient to feed a population of 2,000 per square mile.

The poor people are glad to go long distances for work and food, if they know where they are to be found. They go readily as coolies to the West Indies and Mauritius. But if Bengal were properly furnished with roads and canals of irrigation, navigation, and drainage, might not a population half as large again as the present be maintained in health and comfort? Are not the vast tracts of jungle—fertile land, but without population—quite as striking a feature in Bengal as the dense masses of rural population in the cleared parts?

Periodical inspection necessary.

6. If a complete system of drainage were carried out, periodical inspection by specially appointed officers would be essential to prevent the destruction of the smaller channels and consequent outbursts of fever. It is astonishing how evils are unseen by eyes accustomed to them.

Village water supply.

7. Every village should have its pure water supply.

The present state of the supply in Bengal is shocking beyond description. The water drunk by a large portion of India is utterly unfit for men's use, and is often brought from miles distant. Much might be done by the people themselves, under proper supervision, in the way of clearing out and deepening existing tanks. But this should be combined with a fresh water-supply from the great rivers by means of the subsidiary irrigation channels.

Wherever we have irrigation the people have this, and appreciate it highly.

But, if we are to have all these things, there *must* be, we are told, some tax of the nature of a water-rate (as in towns), to be levied on the whole community.

It is impossible to regulate the drainage and water supply of vast tracts, like those in Bengal, except at an expense which cannot be met, it is said, by the mere receipts from *irrigation*, which (with navigation tolls in the canals) have hitherto been our sole source of profit. There is no question about returns, however, *if the water is used*; and, if it is not, it can only be from mismanagement, as in Orissa. Col. Haig remarks upon the 'far stronger feeling of confidence and security which prevails under a Ryotwari settlement' (speaking of the Godavery) 'than under a Zemindari.' When a Cuttack ryot is asked why he does not use the water, which he acknowledges is so profitable, he says, 'What is the use of it, when half the profit goes to the Zemindar and half to the money-lender?' While the water has been generally

refused this year, a considerable extent has been irrigated surreptitiously; and when one of the engineers was reporting about it, a Native Revenue official told him he had had his predecessor turned out, and he would have him turned out too if he reported it. Such is the confusion in these districts. Such the relation between the State and the 'creatures of its own creation,' the Zemindars. Such the difference between the Ryotwari and Zemindari tenures.

8. It is here, however, that the Government hesitate, or rather that they have drawn back.

Lord Mayo's Government was in favour of a compulsory rate in all irrigated districts.

Lord Northbrook and Sir G. Campbell are against it.

But, without it, it is said that irrigation and drainage (if the works are to be constructed by Government) can never be carried out on a scale commensurate with the wants of the country.

Is there much diversity of opinion, however, where the water is *actually given*? But then no compulsion is needed. Are not the people only too glad to get and pay for the water, as fast as they can prepare their fields and get manure? But are we not always in a hurry? and, after shutting our eyes for years to the truth as to the value of irrigation, always trying to force the poor cultivators to take the water the very instant we ourselves are converted to a sense of its value, and charging them for all the blunders we have made in supplying it?

Nay: do we not even go further and make laws

enabling Government to charge for the water, even if it is not supplied: if we only intended or promised to supply it?

Was not Lord Mayo's proposed law of this character?

Had he lived, he would have modified it, so as to charge for water only where actually given. But really no *law* is needed. If we only make the works, bring the water, and sell it at reasonable rates, the people are only too glad to buy it for their fields.

Was not Lord Mayo misled, for the time, by a policy—better at drawing up symmetrical laws which looked well on paper, than in carrying the people with it to *do* what was needed?

The Duke of Argyll's final decision against such a rate is said to have stopped two or three immense irrigation schemes (one for five millions of acres in Oudh) in the very part of the country which is either now threatened with famine; or, not threatened—the famine is upon us.

But was it so much the 'Duke of Argyll's final decision,' as the mistakes of Lord Mayo's unfinished policy which stopped the irrigation schemes?

Did not Lord Mayo fall, for the time, into the hands of the Fisherman's wife, who never would make the best of what the Enchanted Fish gave her, but always wanted something better? She, after somewhat violently opposing Canalisation for years, went far beyond its demands, and would do nothing till an Act was passed to enable her to tax every Ryot in India for water, as soon as she

had good intentions of irrigating his fields. And when she was told she must tax only after she had given the water, she sulked, and would not amend her Act.

So with Loans: there was no end of writing and planning, but it never got beyond paper.

They never borrowed the money, because they were always following some new butterfly of Finance.

And so they never had it to spend.

Nothing can be more just than a partial compulsory water-rate in the irrigated tracts, because, whether the people irrigate or not, they have the enormous benefits of navigation, drainage, drinking-water, forage, &c. Under the Orissa Works, at £3. 10*s.* per irrigable acre in cost of works, $2\frac{3}{4}$ rupees an acre would pay 8 per cent., leaving the transit free, and the increase of produce 15 rupees an acre at least.

The water-rate paid in Godavery on about 500,000 acres, at 4 rupees, is £200,000; but the increase of Revenue has been above £300,000.

If no water-rate at all were levied, it would be impossible to prevent the works paying, from the increased revenue due to the increased wealth of the people. As a native gentleman wisely said, the Government of a rich population can never be poor.

But at this moment, including all mistakes in projection from want of experience, and the temporary failure from refusal of water in Orissa, all the new works would show a direct net return of some 20 per cent. into the treasury, and at least 100 per cent. in all.

If the Canal is completed up the valley of the Ganges it will carry two million tons a year at $\frac{1}{10}d.$ per mile, and at all speeds, from that of the Railway downwards, against 200,000 tons carried by the Railway at $1\frac{1}{2}d.$ a mile, though supported by half a million a year paid out of the treasury as interest of its debt.

But Railways are wanted as well as Canals. And as matters now stand, must they not be made before Canals? Must we not do what comes to our hand to promote communication, without limiting ourselves to what is abstractedly best? It has been truly said that, while 'we want waggons to carry hay, we provide phaetons.' But, if we want to get across country, do we not take what the country affords—jaunting car or broken-down gig? People here will give their money and labour to make Railways and not to make Canals. Shall India wait till they get wiser, or let internal improvement, which depends so much on easy intercommunication, stand still till she has made them wiser?

If all the Canals which the great artist has devised, and which he could give men to execute, were made, the works would then convert the world.

Meantime, we should get all the Railroads and common roads made which we could find money or men for; certain that, if not the best and cheapest, they are the next best, next cheapest appliances we can give the country.

Is it not the fact: that we want both Railway and Canal?

And must not the Canal, which will supersede Rail-

ways, be very different from any Canal we have yet seen?

But we may believe in its coming—that is, a Canal workable by steam as well as by animal power ;—and able to carry at 10 miles an hour.

That we shall see this in India before it appears in Europe is likely.

But will anything save example convert the world?

Meantime, even if we give India only Railways, the people will neither starve nor stagnate.

9. *There is no great new irrigation work in India that is not paying ample direct net profits*, excepting that of Orissa; and that not at all on account of any real failure in the project, but only from the non-use of the water, which will of course be got over before long, and there is not the least probability of its occurring anywhere else.

Indeed, the so-called failure of the Orissa works is mainly due to the tardy and incomplete execution of the original scheme. Government no sooner saw that the works *must* be a financial success than they bought them—and then starved them—waiting for more plans, estimates, and paper, before the money to complete them was given. We saw the 'Hay-waggon,' in fact, and were charmed with it, and bought it as it stood, half-finished ; and have since been doubting whether we can afford to complete the wheels, and whether the tyres should be broad or narrow.

10. The question will now be *forced* on public

attention. It is no longer a question. The famine looms large and terrible upon us, as an awful fact.

at has
n done in
gation.

It must not, however, be supposed that little is being done in the way of irrigation.

In Bengal alone we have been spending, for some years past, half a million annually; and that is only one province.

There is said to be a practical limit to the rate at which such extensive works can be carried on—viz. available labour supply. If this is pressed upon unduly, wages rise (Oh, would they should!), and with them the price of all materials of construction. In Southern Behar and Orissa we are said to have quite reached this limit, for there has been a considerable increase in rates since the works were begun. But is not one of the most important effects of these works that they help to release the labouring population from their bondage to the high castes and wealthy, and in all ways improve their condition and raise wages?* Every district could easily provide labourers for an expenditure of £100,000 a year, requiring about 20,000 people; and £30,000,000 could easily be spent in three or four years.

There is said to have been much, too, in our recent

* The works in the Godavery essentially altered the condition of the whole body of labourers almost immediately. The employers found that their most energetic men would leave them for the works, if not better treated. And thus the employment of 30,000 people at good wages, with thoroughly good treatment, affected the welfare of a million. The state of the agricultural labourer was low enough in England; it may be supposed what it is under Indian landowners of *high caste*.

experience of irrigation in Bengal—chiefly the unwillingness of the people to take our canal water, except when driven to it by the failure of the rains—to cause the Government to pause before beginning new schemes, without some such guarantee for the repayment of the interest on the outlay as a compulsory rate would afford. The works are all carried out with loan funds, and the interest must be met from some source. But, as above said, our expenditure has been, and continues to be, £500,000 per annum.

As far as has been seen in India, however, 'the unwillingness of the people to take canal water' really means 'our own bad management' in some way or another.

One can hardly conceive now but that, even had famine been averted, the great drought would not have given a vigorous impulse to this most important class of land improvements.

But famine *has* come.

In Lower Bengal the field for *drainage* is boundless.

Who is to pay?

There, however, the one question which stops the way is whether Government will make the Zemindars, who are the possessors of the soil, pay for the works or not. Here there is great hesitation. *Are* the Zemindars so selfish and worthless a class as to exercise their considerable influence over the Government in this way? And *would* they resist, as is said, with all their might?

Drainage experiment on the Hooghly.

The drainage, however, of about eighty square miles of swamps on the banks of the Hooghly is now

being carried out at the expense of the landowners, under a special Act; and Government would probably have awaited the result of this experiment before extending the Act to greater schemes.

But if the famine interrupts everything it must also urge forward everything.

May it not also force the authorities to look in the face the terrible evils of the whole Zemindarry system? Is not the case something similar to that of the old Bengal army; and, if it is still ignored, may not a similar terrible convulsion ensue?

The subject is so vast that it is impossible to do more than just touch upon the principal points here.

II.

Crops improved.

1. Irrigation and drainage improve the crop, and give crop when and where there would be none. Consequently—

Who is to profit?

2. These combined works improve the entire value of the land: and the question is, Who is to reap the increase?

The Zemindar?

3. This must be either the Zemindar and his subordinates, who have spent nothing, or the Government which finds the money, or the ryot who cultivates. In England we should force the Zemindar to bear his part by a Poor Law to compel him to feed the suffering people, in the hope that he would find it cheaper to irrigate and drain than to feed.

Or we should pass a law calling on all proprietors to improve the drainage, irrigation, and roads over their property, on pain of being taxed for the support of their people every time that famine comes—something as we did in Ireland, where we charged for famine and where the landlords had to pay over and above what other landlords had to pay, because the people were dying. *Should not the fixed land-tax rest only on the basis that the people can live and not die?*

This was, in fact, Lord Cornwallis' principle. People blame his 'Permanent Settlement,' but they forget that the best half of his plan was never carried out by his successors. He clearly intended to make the Zemindars maintain a police, make roads, and do all other things that a landowner should do. But when he died his successors went to sleep.

4. Drainage and irrigation will improve the stamina of the entire working population; but of this improvement the Zemindar, if untaxed for the work, will reap the whole profit.

'The husbandman that laboureth must be first partaker of the fruits.'

In Godavery there is no comparison between the present condition of the people and that before the works. But the extraordinary effect these works have had in the improvement of the people's bodily strength and spirit is one that is not generally observed. In Godavery the difference between a people under-fed and working utterly without hope, and the same people as they now are, is most striking. There is, perhaps, nearly three times the amount of work done by the same population, now that they are well

fed and more sure of fair treatment than they were before. When we began the works, we used to find in cutting the canals, that large gangs would average one cubic yard per day; and this rapidly increased to three under exactly the same circumstances. Well-to-do, the people have now no look of poverty.

Value increased.

5. Hence sanitary work, such as this, creates a great surplus value over and above the present value; and, when we consider the millions of acres to be improved, the addition will be very great.

Conjoint liability.

6. Would not the best course be in India to take a lesson from the present distress, so as to plan for the future some conjoint liability for the drainage and irrigation works?

The Hooghly scheme will afford valuable indications on this point, because the increase can be used as a standard.

But the difficulties in the way are said to be enormous, arising from the extremely complicated state of property and innumerable interests in the land in permanently settled Bengal, and from the engagements made with the landholders under existing settlements elsewhere. Some idea of what these are in temporarily settled districts may be gathered from the Orissa irrigation scheme: they are far greater in the permanently settled.

Also, is it right that the revenue for the whole of India should bear the cost of improving the revenue of the Bengal Zemindars?

Would they wish it themselves?

We cannot believe this of a noble body of Indian gentlemen.

Should not the local revenue be augmented to pay for this?

Also, if money is borrowed, it must be repaid with interest, although it is applied to the improvement of private estates.

Clearly, in some way or other, justice requires that men who own these lands, on which so many thousands die from preventable fevers—and now and then from a famine, which counts its deaths by hundreds of thousands—should either pay, or the Government should remove the people (one of our alternatives), in which case the value of land will cease to exist.

Practical solutions.

7. Should not the landowner be made liable by law to pay for all that is really *done* to improve the land or to save the lives of the people on it? Is not the real practical solution of the financial problem a scheme like that applied to Lancashire after the cotton famine —a fund administered by trustees who lend from it, on security of local revenues, for works of permanent value to the reproductive powers of the locality, the advances to be repaid by instalments from local revenue at such rates as shall extinguish the debt in a reasonable term of years?

Or should not the Government do as they did in Ireland—advance money to the landlords, and send to the Encumbered Estates Courts all who could not repay them?

Such plans have been often laid before the Government of India; and, no doubt, *some time* will be adopted.

One effect of the famine may be predicted, and that is, that it will lead to a revolution in the Zemindarry system in Bengal; which, in its effects on the mass of the population, can be compared to one thing only, namely, the slavery system as it was in the United States.

Pecuniary loss in labourers' deaths exceeds cost of works.

8. The wealth of an agricultural country is the result of labour; and, in a properly governed country, labour ought always to be producing wealth.

Every efficient labourer is a wealth-producing agent; and every efficient labourer, lost by death, is a pecuniary loss to the country.

These are truisms.

The people pay $2\frac{1}{2}$ rupees per head in taxes—the interest of 50 rupees, sufficient to irrigate 2 acres, which would support 5 people: and in actual famine 10 rupees would certainly provide food per head through the famine.

Scarcity and famine act in two ways; they reduce the wealth-producing power of survivors, and destroy the wealth-producing power of those who die.

When labourers die by thousands on account of famine and epidemics, because the ground on which they existed was left without irrigation and drainage, it may be affirmed with certainty that the pecuniary loss to the country exceeds what would have been the cost of works.

May not this be safely assumed as a law of the universe from which there is no escape? We may cry back on account of the cost of doing what Nature says must be done: but this will not prevent her from presenting her bill at the due time; and when presented it must be honoured, whether we will or no.

A large part of India is occupied on these conditions, and an awful bill it is.

9. But the people are not the only sufferers. Our noble Indian army, although it may be saved from famine, is doomed to the inheritance of epidemics which always begin among the people. Army.

We know all this now. The sanitary history of the British army in India begins with the sanitary history of the Indian people.

III. *A few Facts about Canals.*

Colonel Rundall, the Inspector-General of Irrigation, projected, and for the most part worked out, the plans and estimates for the following schemes:— Irrigation.

The Sone scheme, for the irrigation of the Shahabad, Patna, and part of the Gya districts south of the Ganges, included in the great tract now in danger of being laid waste with this dread famine. This work is in hand. Sone.

The canal, from Monghyr to Mirzapore, will be 180′ wide at bottom, with a depth of 8 feet, and a length of about 180 miles, of which 30 miles have been excavated to one-half of the full section. This

canal will be used not only for irrigation, but for connecting the Lower Ganges with the Great Ganges Canal. Its great size renders it well adapted as a relief work, as large numbers can be massed upon it, which has already been done; and the railway, at no great distance, will enable food for the labourers to be supplied at different points along the line.

There are other smaller canals (40 to 50 miles in length each) forming parts of the same scheme.

The execution of some of these, it is understood, has been ordered.

The Sone works irrigate South Behar, south of the Ganges. Their value, as part of the grand line of communication up the valley of the Ganges, will be even greater than for irrigation. From Allahabad to Monghyr is 300 miles, and on this part two million tons would be carried per annum; saving, even compared with the river, about $\frac{1}{2}d.$ a ton a mile, or £4,000 a mile—£1,200,000 a year in all. This is besides many hundred miles of branch canals. If the works cost four millions this alone would be 30 per cent.

Gunduck. There are two proposed canals on the Gunduck, a tributary of the Ganges on the north, to supply the Chumparun and Tirhoot districts on the one side, and Sarun on the other—through the middle of one district of the famine-stricken country.

A fight was certainly made to start one, at least, of these at once.

Damoodah. The Damoodah Canal project was brought forward in Lord Mayo's time, and a beginning made; but

Government afterwards stopped the works, on the ground, it is said, that as coal had been found at Midnapoor, it *might* not be necessary to carry the coal from Raneegunj. Shortly after, on the convict in charge of the boring at Midnapoor being relieved, his successor asked whether any more coal had been found, and was told by the native in charge that they had not put any into the bore lately. But on this discovery Government did not re-order the Damoodah Canal.

Under this pressure of famine, however, it is likely to be resumed, with two or three other stopped works. Two modifications of it, though poor substitutes indeed, were wisely suggested, in hopes of getting some irrigation started, and of them the little canal from the Damoodah in the Hooghly district has been ordered to be carried out. But the works had not been begun; and we may still rejoice to hear that Colonel Rundall's original scheme has now been accepted by Government in its integrity.

Moorshedabad.

There is the great canal, which it is proposed to construct from the Ganges at Rajmahal, and to bring down beside the Bhagiruttee (the name given to the upper part of the Hooghly) to tide water near Calcutta.

This would irrigate Moorshedabad, now so cruelly suffering, and Nuddea, and enable boats and steamers to avoid the difficulties of the navigation of the Bhagiruttee, and the circuitous route through the Sunderbuns.

It would be a magnificent work: was originally proposed by Sir A. Cotton, the most perfect master

of the question living (by others, indeed, it is said, before him), and the plans worked out under Colonel Rundall's orders.

2½ millions acres.

The first three schemes, above mentioned, would afford irrigation for at least 2,500,000 acres. If they had now been in operation, the saving of crops, irrespective of the increased yield due to irrigation, would have been half a ton per acre. So that 1,250,000 tons of food would have been *secured*, which has now been lost—enough effectually to have prevented famine, and perhaps even scarcity.

In North Behar and Oudh, the great works projected have all been stopped.

Is there one of the many works thus stopped that would not have entirely prevented the famine in its tract?

The Rajmahal Canal has been thoroughly projected, and might be begun at once. It will form 200 miles of the main Ganges Valley Canal, and can be connected with the Sone Canals by a link of about 70 miles. This, with the Sirhind Canal from the Sutlej to the Jumna, the Ganges Canal to Cawnpoor, another lower Ganges Canal to Allahabad, will form 1,200 miles of perfect steamboat navigation, the finest navigation in the world, and will save at least £4,000 a mile, £5,000,000 a year, as compared with *river* transit. On the railway alone there is actually paid £1,600,000 for the carriage of goods only, at 1½*d.* a ton ; on the canal this would cost, at $\frac{1}{10}d.$, £100,000, saving £1,500,000.

Such are the sums India is losing for want of cheap transit.

But if a complete system of canals were cut on all the main lines, every part of India would pour food into any distressed tract in any quantities, and at a nominal cost of carriage.

A return showing the extent of irrigation in Madras Presidency, gives 4,800,000 acres, and the real area is above this. This is at the rate of 250,000 acres per district. About 40,000,000 of acres more, besides the works in progress, would give every district in India 250,000 acres, and cost about £100,000,000, producing an additional value of grain of about £200,000,000 a year, besides the transit; the whole benefit being certainly eight or ten times the whole amount of taxation, £40,000,000. That is, it is in our power in this way to do eight or ten times more for enriching India than the abolition of all the taxes.

The total paid into the treasury in Madras for water is about £3,000,000 a year.

The Sone works are now watering more than 130,000 acres—the first year, the water-rate of which would be, at 3R., £40,000—on a present expenditure of about £500,000, including all the fundamental works; and the value of crop is estimated at £450,000.

Such is the real case of irrigation.

Do not many write as if all irrigation had been a loss to the Government, and the one difficulty how to obtain it without overwhelming burthens on the

country? The Godavery works alone, in their present unfinished state, pay the interest of £5,000,000.

Is there anything to prevent the Government ordering at once the irrigation of from 250,000 to 500,000 acres in every district in India, including a complete network of steamboat canals of 20,000 or 30,000 miles, embracing all India, and to be completed in five years, with an absolute certainty of two or three times the present interest of money in direct returns? The Sone works are calculated to irrigate about 2,000,000 acres, paying £500,000 water-rate alone, or 12 per cent. on £4,000,000.

The water-rate paid in Godavery is 4rs. per acre of *rice* ; on the Ganges Canal 2½rs. an acre of *wheat.* Some of the old irrigation in Madras used to pay 20rs. an acre ; some now pay, it is said, 12rs., and much pays 8rs.

Two millions a year are now actually paid for goods transit between Calcutta and the confluence of the Ganges and Brahmapootra, a distance of 130 miles, £15,000 a mile per annum; while £3,000 a mile would make a perfect steamboat canal, carrying at ¼r. a ton for the whole distance, or £50,000 for the present 2,000,000 tons, producing a saving on the *present traffic* of 500 per cent. ; this is besides about 1,000,000 tons that would be carried along the first 100 miles of the canal for the Upper Ganges. And at this charge the present traffic would be soon doubled.

On this little line of 130 miles, a saving would be effected of at least £3,000,000 a year, including the new traffic.

N.B.—Seven-eighths of the traffic still go by a very bad navigation of 470 miles, three times the distance by rail, and taking six weeks on an average.

Is not the Government of India too much like a dispensary, which does all that man can do to cure when too late to do anything to prevent?

Dispensary Governmer

IV.

These facts speak loud: I have no need to add my poor words. He who runs may read.

Are we to p out of curre revenue?

What is the answer given by modern 'financial policy' or impolicy? That we must only do what we can pay for out of current revenue, or at least what will pay for itself at once.

[Instead of interest enough not being taken in India, too much, it would seem, is taken—an ignorant, unsound interest. So much the worse for India.]

It seems like going back 500 years: to the times when our beds were our banks, and we took out of our old stocking, hid in the mattress or in a hole in the floor, enough for a miserable sustenance day by day, careless of whether we starved or died 100 days hence.

Christ himself tells us not to bury our talent in a napkin, but to put it out to interest.

'Sound Indian finance' appears to be what Plato calls 'wanting to have money safely kept and not used,' or 'justice useful' and 'money useless.'

Is it not as though we said: It is 'unsound financial policy' to live unless you have money in your stock-

Or by loa

ing; to borrow in order to build, or to trade, or to farm; you must not make railways except you can pay for them out of your income, nor telegraphs, nor any means of communication by steam or water?

Is not this reversing the whole principle which has given England her unparalleled success in trade and manufacture—her greatness, as a nation, over the whole globe?

Unless you have money in your stocking to do it, we say in India, don't do it; you must not utilise the money in your neighbour's stocking. You can't eat roads, or railways, or canal-banks this year, though they may bring you a hundred-fold produce in twenty years. Be not fools who spend their money, unless, having £100 in your mattress, you can see £110 for every £100 in your mattress before Christmas. Eat what you can grow in your garden; you can keep your own money safer than anybody else can use it for you.

Is it 'extravagance' to provide for ten years hence, or even, as this famine has but too fatally proved, for one short year hence, what we are to eat then?—or die of starvation—unless we can provide with the money now in hand?

Is it 'sound finance' to let a man starve a year hence, and live this year by eating up all he has?

Is it cheap to let him die, too dear to make him live, if you have to provide for his next year's food on borrowed capital, even if that capital returns cent. per cent. in future years; and even if—*not* borrowing it—you spend next year millions where you would

only have had to spend thousands this year, besides the small item of a few hundreds of thousands of acres of depopulated country?

Is it cheaper to let a man 'get dead' than to feed him or house him, on borrowed capital?

Then comes the drought; and costs us tens of millions instead of millions, to say nothing of a million or two of people who 'get dead.'

To thrust these poor remarks upon those who know it all so much better than I, and can put it so much more forcibly, seems needless.* This appalling

* It will, perhaps, be said that the loan system has been now adopted, and public works are no longer carried on out of current revenue only;

That the Government is no longer in the position of the old woman with the stocking;

That the principle has long since been admitted that the cost of such works should not be borne by the existing generation, which has only a life interest in them, but in the shape of interest upon public loans by succeeding generations, which will equally benefit by them.

But this is not true. Loans have been *talked of*, but not raised, nor sanctioned till Famine came; and now the money may be spent—not in preventing Famine, but in feeding and keeping alive some of its victims.

It will perhaps be said that for years the whole expenditure on irrigation and State railways has been defrayed from special loan funds.

But this is not so.

That the Government is open to blame for not having conceded the first sooner, and also for not having pushed forward such works fast enough, though the immense establishments which it has been necessary to organise could only have been got up by degrees.

But this is hardly true.

Why did they stop private companies fro n doing the work?

There has been fatal hesitation for the last three or four years,

famine speaks louder than any man can do—or woman either.

not so much in carrying on the schemes actually in hand—for some of these have been prosecuted and funds supplied as fast as the engineers could submit estimates and designs – as in starting new schemes. And this has chiefly arisen from the presumed discovery that the promises held out by the advocates of irrigation of high direct returns are illusory (made so indeed by our own mistakes), and that, with the notable exception of some great works in Madras specially conditioned, such schemes do not, and for many years to come will not, pay the current interest on the loan capital invested. This is what is said.

But then why did they abolish the Income Tax?

There is no doubt that such works do vastly enrich the land and add to the general wealth of the community, and it may safely be concluded that, directly or indirectly, they must eventually pay—even in spite of our own mistakes.

In permanently settled Bengal, the Government, in laying out money upon irrigation, is always said to be in the position of a man who, having given his property in lease *for ever* at a mere quit-rent, proceeds to lay out vast sums upon it. The tenant reaps the whole profit.

From whence, then, are returns to come? Increased wealth will lead to increased consumption, but of what? Opium or spirits? God forbid. Let us hope that these two sources of income are to decrease, not increase. Salt? The 'Poor Man's Income Tax?' God forbid again, we say.

What, then, are we to look to?

Should not the Government do as they did in Ireland—advancing money to the Landlords?

Or as was done in Lancashire after the Cotton Famine?

But when Lord Mayo's tax was negatived, as above recounted, both he and the members of his Government, who had up to that time been staunch irrigators, drew back, and refused to advocate any new schemes without such a guarantee.

And so matters have stood.

Has not the old woman been to blame, although she had begun a little to mend her ways before the day of retribution came, too late to avert the sad fruits of former error?

But one must live in order to be a subject for sanitary considerations at all; and one must eat to live. If one is killed off by famine, one certainly need not fear fever or cholera.

CONCLUSION.

This great essential work of the regulation of the water of India is perhaps at this moment the most important question in the world; or rather not question—action.

Nothing can compare with it for the material progress of the people, and their moral progress is greatly dependent upon it: for, till the people are in a measure relieved from their bondage to poverty and want, they cannot attend to other things.

Another very important point, and intimately connected with irrigation in all ways, has to be taken up: and that is, the subject of manufacturing in India.

There are at this moment at least 100,000 horse water power available and made no use of in the great irrigation canals. The canals will convey the goods to and from manufactories, and the irrigation will set free millions from agricultural labour for such work.

With cheap labour, cheap power, cheap carriage, and cheap food, India will have the very highest advantages for manufacture, for civilisation, and also for life, and all that makes life worth having to those whom God has created higher than the brutes, and only a little 'lower than the angels.'

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